REMARKS

Claims 1-4 and 26-29 are all the claims currently pending in the application. Claims 1 and 26 are amended.

As a preliminary matter, Applicant wishes to thank the Examiner for the courtesy and helpful remarks extended to the Applicant's representative during an interview conducted on July 16, 2003. An interview summary accompanies this amendment.

Claim Rejections - 35 U.S.C. § 102

Claims 1-4 and 26-29 are rejected under 35 U.S.C. § 102(b) as being anticipated by Alumot et al (5,699,447). For at least the following reasons, this rejection is traversed.

The Invention

In the previous amendment, Applicant reiterated that the present invention is directed to a pixel based inspection, rather than a pattern based inspection of semiconductor wafers (specification at page 7, lines 1-3). The basis for this comparison is the scanning of individual pixels of the semiconductor wafer defining a signature of each pixel. In the present invention, a determination is made as to whether the pixel signature has characteristics of a faultless or a defective pixel (page 11, lines 2-7). It was emphasized that all the claims refer to the signature of a pixel, which is expressly defined as the area [of the wafer] covered by the spot of the beam at the moment the sampling is carried out (page 16, lines 19-22) and is not used in the traditional sense to mean an element of a display image.

The specification identifies the importance of pixel based inspection. Specifically, it is taught that such pixel-based inspection can be performed without requiring reference pattern data. Moreover, acceptable pixels and suspect pixels can be classified individually. Finally, there is no need to compare patterns or use specific information about the patterns, in accordance with the teachings at page 9, line 25 - page 10, line 2. In short, throughout the entire specification, the distinction from and benefits of a pixel-based analysis is taught and is distinguished over a pattern based analysis as in the prior art.

Alumot

During the interview, the Examiner acknowledged that the Applicants' definition attempts to define a pixel-based inspection without requiring reference pattern data. The

Examiner also acknowledged that Alumot requires reference pattern data. However, the Examiner asserted that the disclosure in Alumot can be interpreted as requiring a "pixel signature," as claimed. The Examiner suggested that the claims should be amended to state a definition of "pixel signature" in a manner that distinguishes over Alumot.

The Examiner noted that in Alumot, strings of pixels of images related to an inspected pattern and a reference pattern are generated and compared. The detection of defects based upon a comparison of the two streams is disclosed beginning at col. 10, line 47 with respect to a pixel characterizer 72 and a pixel characterizer 74, together with a comparator 77, as illustrated in Fig. 14. In that figure, a digital image is presented to a threshold processor 70, and then passed on to the two pixel characterizers in parallel. The output of the pixel characterizer 72 is provided to a score calculator 73, which also receives the output of a reference die memory 75 and generates a score output. The output of the pixel characterizer 74 is provided to a comparator 77, which also receives the output of a reference die memory 75 and provides an alarm output.

The pixel characterizers 72 and 74, score calculator 73 and comparator 77 are described at col. 11, lines 41-col. 12, line 43 and col. 12, line 64-col. 13, line 37. . Pixel characterizer 74 computes the type of a <u>current pixel</u>, and pixel characterizer 72 selects registration points on the basis of the pixel type. Score calculator 73 computes a score matrix of correlation between the inspected and reference images <u>in all the possible shifts around the current pixel</u> up to a maximum. The comparator 77 performs a comparison between the inspecting image <u>in the vicinity of a current pixel</u> and a reference image <u>in the vicinity of the corresponding pixel</u>. That comparison is conducted with respect to a variable threshold level that is dependent on pixel type of the current pixel in the reference and inspected images.

The description of the pixel characterizer 74 beginning at col. 14, line 48-col. 17, line 20 and the description of the score matrix calculator 73 beginning at col. 17, line 22 all rely on a <u>3x3 matrix of pixels</u> for comparison. Specifically, the pixel type characterizes 74 includes 5 comparators $74b_1$-$74b_5$ to compare ratio, gradient and maximum it was previously computed in unit $74a_1$-$74a_3$. The assignment of a pixel to a particular type is described at col. 15, line 2 but the use of a 3 x 3 image is described at cols. 17 and 18. Thus, the function of the comparator 77 to carry out a comparison between the inspected image in the vicinity of a current pixel and the

referenced image in the vicinity of the corresponding pixel <u>involves something more than a signature of the a single pixel.</u>

The defect detector, as disclosed beginning at col. 19, line 52 refers to a comparison of an inspected <u>image in the vicinity of a current pixel</u> and the reference <u>image in the vicinity of the corresponding pixel</u>. Again, this comparison is based on a 3x3 neighborhood matrix centered on a pixel of interest. Thus, any developed signature would be based on a group of pixels in a 3 x 3 matrix as explained at col. 20, line 2. Specifically, a pixel is compared to the 9 pixels in the 3 x 3 neighborhood centered at the corresponding reference pixel. Each of 9 comparisons is made by the comparing the difference between energy of the compared pixels against a threshold determined by the pixel type. The energy of a pixel is the sum of the 9 pixels in the <u>3 x 3 neighborhood at the pixel.</u>

The phase 2 examination, which is disclosed beginning at col. 21, line 73 also discusses a comparison of gray level images "pixel-by-pixel", <u>using surrounding pixels</u> and adapted thresholds having an output to a compare circuit 27 that indicates suspected defects, location and score.

Claim Amendments

In the specification of the present application at page 13, a pixel signature is characterized by (1) the energy of the scattered light, (2) height of the surface, (3) polarization of received radiation in P and S planes, (4) phase of the received radiation and (5) wavelength of the received radiation. As explained at page 15, line 19, the signatures are defined by an array of signals, each of which measures the intensity of light scattered by the pixel in a direction and called a "signature component". The term pixel is defined as the area covered the spot of the beam at the moment of sampling. Thus, as explained at page 17, in order to determine whether a signature has the characteristics of a faultless or a defective pixel, criterion may be adopted that comprise a comparison between a controlled signature and a master signature. In any event, it is the characteristic of a <u>single pixel</u> rather than a group of pixels that appears to be the basis for a signature component.

In order to distinguish the invention over the teachings in Alumot and to satisfy the Examiner's requirement for a definition of "pixel signatures" in the claim, Applicant has added

the limitation to independent claim to claim 1 that states the method involves an evaluation of the way a pixel (alone) responds to the light of a scan beam "**without** reference to adjacent pixels." Applicant also added a limitation to claim 26 so that it states: "said pixel signatures being defined **without** reference to adjacent pixels." .

Applicant respectfully submits that such amendment accurately reflects the present invention and its distinction over the approach taken by Alumot.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.
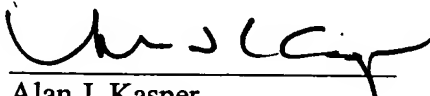
Respectfully submitted,

Alan J. Kasper
Registration No. 25,426

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE
23373
CUSTOMER NUMBER

Date: August 7, 2003

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of   Docket No: Q67625

SMILANSKY, Zeev, et al.

Appln. No.: 10/003,347   Group Art Unit: 2623

Confirmation No.: 6579   Examiner: Vikkram Bali

Filed: December 06, 2001

For: A PIXEL BASED MACHINE FOR PATTERENED WAFERS

STATEMENT OF SUBSTANCE OF INTERVIEW

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Please review and enter the following remarks summarizing the interview conducted on

July 16, 2003:

REMARKS

An Examiner's Interview Summary Record (PTO-413) was delivered to the Applicant's

representative at the interview and was dated July 16, 2003.

During the interview, the following was discussed:

1. Brief description of exhibits or demonstration: Patent to Alumot (5,699,447).

2. Identification of claims discussed: 1 and 26.

3. Identification of art discussed: Alumot (5,699,447).

4. Identification of principal proposed amendments: A more detailed statement of the meaning of "pixel signature" as used in the claims would be added to the independent claims such that the difference from Alumot's pattern comparison approach is distinguished.

5. Brief Identification of principal arguments: Applicant argued that Alumot was distinguished in the application as directed to a pattern comparison technique rather than a pixel-by-pixel approach using individual pixel signatures as claimed. The Examiner acknowledged that Alumot teaches pattern by pattern comparisons, but noted that the modules 72 and 74 in Fig. 14 are disclosed as having an analysis on a pixel basis. Applicant argued that the comparison still is on the basis of a pattern as the signature is derived from a main pixel and its neighboring pixel. By analogy, Alumot compares words or groups of words on a page while the present invention compares individual letters. The Examiner agreed with this analogy but stated that he could interpret "pixel signature" broadly and would do so in rejecting the claims. The Examiner suggested that an amendment that specified the meaning of "pixel signature" in a way that distinguishes over Alumot's approach should be made.

6. Indication of other pertinent matters discussed: The amendment would have to be made in an RCE.

7. Results of Interview: Applicant agreed to file an amendment to the claims that specifies the meaning of "pixel signature" and arguments that support such distinction over the art.

2

It is believed that no petition or fee is required. However, if the USPTO deems otherwise, Applicant hereby petitions for any extension of time which may be required to maintain the pendency of this case, and any required fee, except for the Issue Fee, for such extension is to be charged to Deposit Account No. 19-4880.
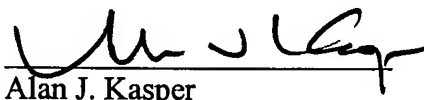
Respectfully submitted,

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

Alan J. Kasper
Registration No. 25,426

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Date: August 7, 2003

3